Food resources and urban colonisation by lorikeets and parrots

Alan Lill

Wildlife Ecology Research Group
School of Biological Sciences, Monash University, Clayton Campus, Victoria 3800

Abstract
Several native bird species have recently successfully colonized many Australian cities. The presence of some of them may be largely beneficial, but their urban ecology is poorly understood. We conducted short-term studies of the foraging ecology of Rainbow and Musk Lorikeets and Red-rumped Parrots in Melbourne parklands to help fill this knowledge gap. The nectar (and/or pollen) of six eucalypt species, mostly not native to the Melbourne area, strongly dominated the lorikeets' diet year-round. The key eucalypt species variously flowered for 80-100% of winter and 72-84% of summer. In winter, 80% of the Red-rumped Parrot's diet comprised the abundant seeds of four exotic grasses and herbs. There was little evidence of significant inter-specific competition, particularly through aggressive interference, for any of the lorikeets' or parrots' urban food resources. Thus a critical factor facilitating urban colonization by these birds seems to be that, collectively, ornamental eucalypts planted last century, turf grasses commonly occurring on sports grounds and in parks and common weeds provide abundant food resources in Melbourne's parklands that are broadly similar to those of their non-urban habitats. Moreover, exploitation of these resources by other urban birds seems to be fairly limited.
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Several native bird species that appear to be increasing in abundance and expanding their geographic ranges have recently colonised many of Australia's major cities. Noisy Miners *Manorina melanocephala* and Pied Currawongs *Strepera graculina* are suspected of adversely affecting whole suites of native bird species in some of our cities (Low 2002), but for other so-called 'urban adapters' (Blair 2001), negative impacts on cohabiting native birds are less obvious and perhaps even non-existent. The reality is that the urban ecology of many of these native, invasive birds is poorly known. We need to bridge this knowledge gap in order to understand what causes and facilitates these urban invasions and to properly evaluate their consequences for urban biodiversity conservation. My research group has been addressing this task by conducting single-season, 'snapshot' studies of the foraging ecology of several of these native, urban invasive species, including that of two lorikeets and a parrot, in Melbourne parkland.

The Rainbow Lorikeet *Trichoglossus haematodus* re-established itself in Melbourne in the 1970s after a prolonged absence, or perhaps a period of extremely low abundance, since the late 1800s (Crome and Shields 1992). It is now abundant and widespread in the city all year round (Shukuroglou and McCarthy 2006). Musk Lorikeets *Glossopsitta concinna* have also increased in abundance in Melbourne since the 1970s (Higgins 1999) and recently their presence has become less seasonal. The range of the Red-rumped Parrot *Psephotus haematonotus* has expanded into south-eastern Australian coastal cities in the last 60 years (Higgins 1999) and for some time now it has been common in some Melbourne parks, particularly in winter. Our studies of these three species have documented their diet and the seasonal availability of their main food resources and examined whether other bird species appear to be significant interference competitors for their food resources in the city (Lowry and Lill 2007; Smith and Lill 2008; Stanford and Lill 2008). The present account draws on these investigations to address the issue of how food availability might have influenced the colonising of Melbourne by these species.

Almost all (99%) foraging by Rainbow and Musk Lorikeets was conducted in the tree canopy stratum. All winter foraging was performed whilst perching upright (59-60% of observations) or hanging upside-down; summer foraging behaviour was similar, although hanging upside-down was a little less common. Eucalypt nectar (and/or pollen) strongly dominated the lorikeets' diet year-round, being the item consumed in 86-97% of over 6 000 forag-

ing observations; seeds, fruit and invertebrates were minor dietary components. Most of the nectar/pollen was obtained from six eucalypt species. The two most prominent species were Spotted Gum *Corymbia maculata*, which accounted for 27-29% of nectar/pollen foraging in winter and 12% in summer, and Red Ironbark *Eucalyptus sideroxylon*, which accounted for 26-27% of nectar/pollen foraging in winter and 17-22% in summer. Yellow gum *Eucalyptus leucoxylon* was also an important nectar/pollen source for the lorikeets in both seasons and Southern Blue-gum *Eucalyptus globulus* accounted for 7-13% of their nectar/pollen foraging in winter. Most of the eucalypts exploited are not native to the Melbourne area. In summer, 61-62% of the lorikeets' nectar/pollen was obtained from these introduced eucalypts and in winter the percentage was even higher (72-84%). Our phenological studies showed that the key eucalypt food plant species in winter variously flowered for 80-100% of the time and the key species in summer for 67-95% of the time.

Collectively, six other native bird species fed on 10 of the 16 winter food plant species of the lorikeets, particularly on the nectar/pollen of Spotted Gum, Red Ironbark and Yellow Gum. Six other native bird species exploited a total of 13 of the lorikeets' 33 summer food plants too, particularly the nectar of Red Ironbark and Sugar Gum *Eucalyptus cladocalyx*. All these potential competitors were honeyeaters (Meliphagidae), cockatoos (Cacatuidae) or parrots (Psittacidae). However, only Noisy Miners and Red Wattlebirds *Anthochaera carunculata* were significant exploiters of the lorikeets' nectar resources and even this exploitation was only at 17% and 4% of the lorikeets' winter and summer usage rates, respectively. Consistent with this pattern, lorikeets were rarely involved in inter-specific aggression over food (winter 0.6 and summer 3.5 interactions per observation week) and most of the interactions observed had little negative effect on the lorikeets' foraging behaviour. For example, being displaced >2 m but not out of the feeding site was the most common outcome for both lorikeets in summer (41% and 59% of interaction outcomes for Rainbow and Musk Lorikeets, respectively). Noisy Miners were involved in 85% of these summer inter-specific encounters.

Red-rumped Parrots occurred at mean population densities of ~ 0.5-3 per ha and in flocks of 1-139 (mean =10) in Melbourne parks in winter. They fed mainly on the ground, less than 2% of foraging occurring in trees. The diet comprised mainly the seeds (78% of foraging observations) and, to a lesser extent, the buds (11%) of thirteen plant species, mainly exotic grasses and herbs. A few flowers of herb species were also consumed. However, just four exotic plant species collectively provided 83% of the diet. Annual Bluegrass *Poa annua* and Kikuyu Grass *Pennisetum clandestinum* seeds together comprised just over half of the diet and the seeds of two herbs commonly regarded as weeds, Knotweed *Polygonum arenastrum* and Chickweed *Stellaria media*, accounted for a further 24% of food items consumed. Our measurements showed that this seed resource was abundant throughout winter. Intriguingly, it was just as available in sites not occupied by, but superficially suitable for red-rumps, as in sites used by them. Thus the mean proportional availability of Annual Bluegrass, based on estimates of percentage cover, was 28.7% in occupied sites and 26.9% in unoccupied sites. However, the occupied sites may have provided better protection for roosting red-rumps diurnally and nocturnally, because they had more tall trees and dense canopy cover. Again, the negligible amount of aggression observed between red-rumps and cohabiting bird species over food (6 encounters in 40+ hours of observation of foraging birds) had little apparent negative effect on the parrot's foraging behaviour; they were either displaced < 5 m or showed no overt response.

Melbourne's parks apparently usually provide an abundant nectar/pollen supply for Rainbow and Musk Lorikeets. A major reason for this appears to be the planting of over 120 eucalypt species, many of which are not native to the area, as ornamentals last century (Beer *et al.* 2001). This diversity, perhaps augmented by the urban heat sink effect and a high soil moisture content resulting from artificial watering (Neil and Wu 2006), has apparently resulted in longer flowering seasons overall and hence an abundant, year-round nectar supply for urban lorikeets (Fitzsimons *et al.* 2003). There seems to be only limited inter-specific interference competition with other birds for this resource. Exotic grasses, commonly occurring in turf in parks and sports fields, along with common weeds provided an abundant seed resource for red-rumps throughout winter in Melbourne.

Critically, Kikuyu Grass, which provided 22% of the Red-rumped Parrot's winter diet, produces seeds prolifically even when regularly mowed (Huff 2002). Exotic and native ornamental trees provide suitable roosts for red-rumps in the city's parks and, as with the lorikeets, there did not seem to be significant inter-specific interference competition for food resources. Melbourne provides food resources closely approximating those in the three parrots' non-urban habitats (Higgins 1999), so dietary flexibility has not been a pre-requisite for urban colonisation by these birds. They may compete with other native animals for tree-hollow nest sites, but otherwise their urban presence seems to be mostly beneficial.

Our short-term studies need to be replicated in additional years, given the known annual variation in eucalypt flowering phenology (Law *et al.* 2000) and possible effects of drought on seeding grasses. Lorikeets also need to be studied in gardens and streetscapes, which they use extensively. The inter-specific competition issue requires further evaluation through a more comprehensive examination of the entire diet of possible competitor species. Finally, we need to see if the Melbourne picture holds for other cities colonised by these parrots and to identify the factors in the parrots' non-urban environment that have led to the urban niche being exploited by these birds.

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Red-rumped parrot *Psephotus haematonotus*. Photo by Virgil Hubregtse.